WEDNESDAY, JUNE 06, 2007

A Coffee Can Foundry... (making bronze, part 4)

This is Part 4 of my mini-saga on attempting to make home-made bronze, using a method similar to Bronze Age technology. Parts 1, 2 and 3 can be found here:

Part 1: Goal, building and initial tests

Part 2: First attempts at metal melting

Part 3: Improving the foundry

Lump charcoal is as lump charcoal does...

As the refractory material (Perlite/fire cement composite) had started to suffer fire damage and the inner lining was losing mechanical integrity, I decided to increase the capacity a little by removing the degraded material (a strange pink salmon type of colour). The diameter of the furnace cavity is now about a 1/2 inch wider and slightly tapered. Next I moulded another 1/4 inch on the top, making it level with the rim of the paint can and moulded a new lid.

The foundry enthusiasts at the ABYMC forum made some more suggestions, from better regulating the airflow, using a hydrocarbon side feed to reverting back from briquette charcoal to the more expensive but hotter burning lump charcoal.

So I bought some new lump charcoal and fired her up, using the smaller pieces of charcoal only. It became immediately apparent that the furnace*burnt considerably hotter than previously*. It glows a nice bright orange, as does the crucible which previously yielded only a dull, dark red, only visible in fainter light.

Here's the furnace with lid during firing:

In the cavity:

The photo's colour is deceptive due to the temperature (the glow is a nice bright orange but not yellow).

A quick test with some 50 g of aluminium (some clean and some painted can scraps) led to melting in a matter of minutes. The resulting blob of clean aluminium shrank a lot because it was way over its melting point when poured.

Then the next litmus test: a 7.5 g piece of engineering brass of unknown composition, with some LoSo flux to improve heat transfer. It melted in about 5 minutes, indicating the required 900 - 950 C (1650 - 1740 F) had been reached comfortably!

One more run with three 2 pence coins (no LoSo) resulted in the coins being sintered together but not melted. Left the splatter of brass and right the three unfortunate 2p copper coins (heavily oxidised to cuprous oxide, I imagine).

I played around a little with the airflow but it didn't seem to make much difference. I'm probably getting close to optimum airflow. *The lump charcoal has the added advantage of producing much less ash, as the briquettes are formulated to generate ash for cooking.*

I'll try and further boost the heat with slightly finer coals but for now there's no need to inject hydrocarbons (propane or butane) into the tuyère. I will try that at a later date in an attempt to push the furnace to its thermal limit.

So, although the temperature isn't yet at the melting point of copper (1084 C, 1984 F), I feel confident that the achieved temperature is *sufficient to glow tin and copper from their oxides using charcoal as a reducing agent.*

My tin oxide is about to be delivered and hopefully my own bronze age will then commence...

Update:

I've just "*gone copper*"! Selecting the smaller lumps of charcoal and breaking up some bigger ones, I melted about 22 g of the same "yellow brass" in minutes. It caught fire and there isn't much left of it.
Carrying on, I tried the three copper 2 pence coins again and they too melted in a few minutes: so *I've got 1084 C (1984 F)!*

Left what's left of the brass, right the blob of molten copper (both splattered onto dry sand):

In fact the oven ran so hot that *the crucible softened noticeably* (it's got a small dent to prove it) because it yielded to my pliers.

Hot, hot, hot!

The whole run was approx. 40 mins and burnt 450 g of charcoal, putting the power output at approx. *6.2 kW (6,200 W).*

The next instalment of this project can be found here.